

Application Number 09/851,363
Amendment in response to Office Action mailed January 8, 2008

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AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

Claim 1 (Currently Amended): A routing device comprising:

a midplane;

a power supply coupled to the midplane to supply power along the midplane;

a plurality of removable interface cards removably coupled to the midplane to communicate packets using a network; and

a router module removably coupled to the midplane separate from the plurality of removable interface cards, the router module comprising a packet forwarding engine, memory, a memory management unit, and an interface card concentrator module wherein the packet forwarding engine, memory management unit, and the interface card concentrator module are integrated into a single unit,

wherein the midplane provides power from the power supply to the router module only when the router module is properly inserted into the midplane,

wherein the interface card concentrator module receives packets from at least two of the removable interface cards,

wherein contents of the received packets are stored in the memory,

wherein the memory management unit generates notifications based on keys of the received packets and forwards the notifications to the packet forwarding engine,

wherein the packet forwarding engine performs route lookups for the packets based on the keys in response to the notifications, and

wherein the interface card concentrator module sends the packets from the memory to the removable interface cards as output bound packets based on the route lookups performed by the packet forwarding engine in response to the notifications.

Claim 2-5 (Canceled).

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Claim 6 (Previously Presented): The routing device of claim 1, wherein the interface card concentrator assembles the output bound packets from data stored in the memory and forwards the output bound packets to the plurality of removable interface cards.

Claim 7 (Previously Presented): The routing device of claim 1, wherein the interface card concentrator processes inbound packets received from the plurality of removable interface cards to remove the keys from the inbound packets, and stores data from the processed inbound packets in the memory.

Claim 8 (Previously Presented): The routing device of claim 1, wherein the memory comprises an SDRAM device.

Claim 9 (Canceled).

Claim 10 (Previously Presented): The routing device of claim 1, wherein the notifications are generated based on extracted information that includes at least one of source address information, destination address information, source port information, and destination port information.

Claim 11 (Currently Amended): The routing device of claim 1[[9]],
wherein the packet forwarding engine module is configured to select the routes for the packets received from the at least two different ones of the plurality of removable interface cards by referencing a forwarding table based on the extracted information, and
wherein the forwarding table stores the route information for forwarding data packets received from any of the plurality of removable interface cards.

Claim 12 (Previously Presented): The routing device of claim 11, further comprising a routing engine to store a routing table.

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Claim 13 (Previously Presented): The routing device of claim 11, further comprising another memory to store the forwarding table.

Claim 14 (Currently Amended): The routing device of claim 11, wherein the memory management unit circuit is configured to forward the packets to the plurality of removable interface cards based on the selected route.

Claim 15 (Previously Presented): The routing device of claim 1, further comprising a redundant router module to process the data packets and to forward the data packets between the removable interface cards in response to malfunction of the router module.

Claim 16–18 (Canceled).

Claim 19 (Currently Amended): The routing device of claim 1[[16]], wherein the memory management unit circuit is configured to provide packet data to the packet processing circuit.

Claim 20 (Currently Amended): The routing device of claim 1[[16]], wherein the memory is further configured to store output bound data.

Claim 21–24 (Canceled).

Claim 25 (Currently Amended): The routing device of claim 10[[24]], wherein the route lookup circuit packet forwarding module is configured to select the route by performing a longest prefix match based on the extracted information.

Claim 26–28 (Canceled).

Claim 29 (Currently Amended): The routing device of claim 1[[16]], wherein the packet processing circuit is configured to remove an L2 header from an incoming data packet.

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Claim 30 (Currently Amended): The routing device of claim 1[[16]], wherein the packet processing circuit is configured to build L2 headers for the output bound packets.

Claim 31 (Canceled).

Claim 32 (Currently Amended): A routing arrangement comprising:
a crossbar arrangement; and
a plurality of routing devices coupled to the crossbar arrangement, at least one routing device comprising:

a midplane;

a power supply coupled to the midplane to supply power along the midplane;

a plurality of removable interface cards removably coupled to the midplane to communicate data packets using a network; and

a router module removably coupled to the midplane separate from the plurality of removable interface cards,

wherein the midplane provides power to the router module from the power supply, only when the midplane is properly inserted into the midplane,

wherein the router module performs route lookups for a first set of the data packets received from the network by a first one of the removable interface cards and for a second set of the data packets received from the network by a second one of the removable interface cards to select routes for the data packets and to forward the data packets between the removable interface cards,

wherein the router module comprises a system control module that performs the route lookups, memory, a memory management circuit, and at least one concentrator module that receives the data packets from at least the first one and the second one of the removable interface cards, and

wherein the system control module, the memory management circuit, and the concentrator module are integrated into a single unit,

wherein the router module receives packets from at least two of the removable interface cards,

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wherein contents of the received packets are stored in the memory,
wherein the memory management circuit generates notifications based on keys of the received packets and forwards the notifications to the system control module,
wherein the system control module performs route lookups for the packets based on the keys in response to the notifications, and
wherein the concentrator module sends the packets from the memory to the removable interface cards as output bound packets based on the route lookups performed by the system control module in response to the notifications.

Claim 33-38 (Cancelled).

Claim 39 (Previously Presented): The routing arrangement of claim 32, wherein the memory comprises an SDRAM device.

Claim 40 (Previously Presented): The routing arrangement of claim 32, wherein the memory management circuit is further configured to provide the notifications to the system control module based on information extracted from incoming data packets.

Claim 41 (Original): The routing arrangement of claim 40, wherein the extracted information includes at least one of source address information, destination address information, source port information, and destination port information.

Claim 42 (Previously Presented): The routing arrangement of claim 40, wherein the system control module is configured to select a route by referencing a forwarding table based on the extracted information, wherein the forwarding table stores the route information for forwarding data packets received from any of the plurality of removable interface cards.

Claim 43 (Previously Presented): The routing arrangement of claim 42, further comprising a routing engine to store a routing table.

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Claim 44 (Previously Presented): The routing arrangement of claim 42, further comprising a memory to store the selected route in the forwarding table.

Claim 45 (Cancelled).

Claim 46 (Original): The routing arrangement of claim 32, further comprising a redundant router module to process the data packets and to forward the data packets between the interface modules in response to malfunction of the router module.

Claim 47–55 (Canceled).

Claim 56 (Currently Amended): The routing arrangement of claim 32[[55]], wherein the router module route lookup circuit is configured to select the route by performing a longest prefix match based on the extracted information.

Claim 57–59 (Canceled).

Claim 60 (Currently Amended): The routing arrangement of claim 32[[47]], wherein the packet processing circuit is configured to remove an L2 header from an incoming data packet.

Claim 61 (Currently Amended): The routing arrangement of claim 32[[47]], wherein the packet processing circuit is configured to build L2 headers and rewrite L3 headers for the output bound packets.

Claim 62 (Currently Amended): The routing arrangement of claim 32[[47]], further comprising a redundant router module to process the data packets and to forward the data packets between the interface modules in response to malfunction of the router module.

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Claim 63 (Currently Amended): A router comprising a midplane, a plurality of interface cards coupled to the midplane, a power supply to provide power along the midplane, and one hardware board integrally housing an interface concentrator that provides electrical interfaces to connect to the midplane to receive incoming packets from [[a]] the plurality of interface cards via the midplane, a packet processing circuit, memory, a memory management circuit, and a route lookup circuit separate from the interface cards to perform route lookups to select routes for a first packet and a second of the incoming packets received from a network by different ones of the plurality of interface cards

wherein the midplane is configured to provide power to the one hardware board from the power supply, only when the one hardware board is properly connected to the midplane at the electrical interfaces,

wherein the interface concentrator receives the data packets from at least two of the interface cards,

wherein contents of the received data packets are stored in the memory,

wherein the memory management circuit generates notifications based on keys of the received data packets and forwards the notifications to the route lookup circuit,

wherein the route lookup circuit performs route lookups for the data packets based on the keys in response to the notifications, and

wherein the interface concentrator sends the data packets from the memory to the interface cards as output bound packets based on the route lookups performed by the route lookup circuit in response to the notifications.

Claim 64 (Original): The router of claim 63, wherein the memory management circuit is configured to provide incoming data to the packet processing circuit.

Claim 65 (Previously Presented): The router of claim 63, wherein the memory management circuit is configured to provide a notification to the route lookup circuit based on information extracted from the incoming data packets.

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Claim 66 (Previously Presented): The router of claim 65, wherein the extracted information includes at least one of source address information, destination address information, source port information, and destination port information for each of the incoming packets.

Claim 67 (Previously Presented): The router of claim 65, wherein the route lookup circuit is configured to select the routes by referencing a forwarding table based on the extracted information, wherein the forwarding table stores the route information for forwarding data packets received from any of the plurality of interface cards.

Claim 68 (Original): The router of claim 67, wherein the route lookup circuit is configured to select the route by performing a longest prefix match based on the extracted information.

Claim 69 (Original): The router of claim 63, wherein the packet processing circuit is configured to remove an L2 header from an incoming data packet.

Claim 70 (Previously Presented): The router of claim 63, wherein the packet processing circuit is configured to build L2 headers and rewrite L3 headers for the output bound packets.

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Claim 71 (Currently Amended): A method of manufacturing a routing device, the method comprising:

providing a plurality of interface modules to communicate data packets using a network;

coupling a midplane to the plurality of interface modules; and

coupling a power supply to the midplane; and

coupling a single router module to the midplane,

wherein the midplane is configured to provide power to the single router module from the power supply, only when the single router module is properly inserted into the midplane,

wherein the router module is configured to perform route lookups for data packets received from different ones of the interface modules via the midplane to select routes for the packets in accordance with route information associated with the network and forward the packets back to the interface modules by way of the midplane, and

wherein the router module comprises a system control module, memory, a memory management unit, and at least one concentrator module integrated into a single unit separate from the interface modules

wherein the concentrator module receives the data packets from at least two of the interface cards,

wherein contents of the received data packets are stored in the memory,

wherein the memory management circuit generates notifications based on keys of the received data packets and forwards the notifications to the system control module,

wherein the system control module performs route lookups for the data packets based on the keys in response to the notifications, and

wherein the interface concentrator module sends the data packets from the memory to the interface cards as output bound packets based on the route lookups performed by the system control module in response to the notifications.

Claim 72-76 (Cancelled).

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Claim 77 (Currently Amended): The method of claim 71[[74]], further comprising configuring the memory management circuit to provide the notifications to the system control module based on information extracted from incoming data packets.

Claim 78 (Previously Presented): The method of claim 77, further comprising configuring the system control module to select a route by referencing a forwarding table based on the extracted information, wherein the forwarding table stores the route information for forwarding data packets received from any of the plurality of interface modules.

Claim 79 (Previously Presented): The method of claim 78, further comprising configuring a routing engine to store a routing table.

Claim 80 (Original): The method of claim 71, further comprising configuring a redundant router module to process the data packets and to forward the data packets between the interface modules in response to malfunction of the router module.

Claim 81 (Canceled)

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Claim 82 (Currently Amended): A method of manufacturing a routing arrangement, the method comprising:

providing a crossbar arrangement; and

coupling a plurality of routing devices to the crossbar arrangement, at least one routing device comprising:

a midplane;

a plurality of interface cards to communicate data packets using a network,

wherein each of the plurality of interface cards are coupled to the midplane; and

a power supply coupled to the midplane to supply power along the midplane; and

a router module separate from the plurality of interface cards to process the data packets and to forward the data packets between the interface cards, wherein the router module is coupled to the midplane,

wherein the midplane is configured to provide power to the router module from the power supply, only when the router module is properly inserted into the midplane,

wherein the router module is configured to perform route lookups for the data packets received from different ones of the interface cards to select routes for the packets in accordance with route information associated with the network, wherein the router module includes a packet processing circuit, memory, a memory management circuit, and a route lookup circuit integrated into a single module,

wherein the packet processing circuit receives the data packets from at least two of the interface cards,

wherein contents of the received data packets are stored in the memory,

wherein the memory management circuit generates notifications based on keys of the received data packets and forwards the notifications to the route lookup circuit,

wherein the route lookup circuit performs route lookups for the data packets based on the keys in response to the notifications, and

wherein the packet processing circuit sends the data packets from the memory to the interface cards as output bound packets based on the route lookups performed by the route lookup circuit in response to the notifications.

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Claim 83 (Canceled)

Claim 84 (Currently Amended): A routing arrangement comprising:

a plurality of routing devices coupled in a crossbar arrangement, at least one routing device comprising:

a midplane,

a plurality of interface modules removably coupled to the midplane to communicate data packets using a network,

and

a power supply coupled to the midplane to provide power along the midplane,

a router module removably coupled to the midplane to receive the data packets from at least two different ones of the interface modules, wherein the router module is configured to perform route lookups for the data packets received from the at least two interface modules to select routes for the packets in accordance with route information associated with the network,

wherein the midplane is configured to provide power to single router module from the power supply, only when the router module is properly inserted into the midplane;
and

a switch arrangement coupled to the plurality of routing devices and configured to switch control from a first routing device to a second routing device, wherein the router module includes a packet processing circuit, memory, a memory management circuit, and a route lookup circuit integrated into a single module,

wherein the packet processing circuit receives the data packets from at least two of the interface cards,

wherein contents of the received data packets are stored in the memory,

wherein the memory management circuit generates notifications based on keys of the received data packets and forwards the notifications to the route lookup circuit,

wherein the route lookup circuit performs route lookups for the data packets based on the keys in response to the notifications, and

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wherein the packet processing circuit sends the data packets from the memory to the interface cards as output bound packets based on the route lookups performed by the route lookup circuit in response to the notifications.

Claim 85 (Canceled)

Claim 86 (Currently Amended) The routing arrangement of claim 84[[85]], wherein each of the plurality of routing devices includes a respective router module comprising a respective packet processing circuit, respective memory, a respective memory management circuit, and a respective route lookup circuit integrated into a respective single module.